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54 **Conveying and separation unit for ballistic projectile arresters.**

EP 0 399 960 A2  
 57 A conveying and separation assembly for the impact material of a ballistic projectile arrester for indoor firing grounds, of the type that comprises a heap (1) of granulated material as the impact material, and mechanical means (7, 8, 9) for sending said granulated material once it has been separated from the exploded projectiles up to the top of said heap, wherein said assembly comprises a variable-diameter worm screw or helical screw (2), that rotates about a horizontal axis and is arranged within a half cylinder (4) which is open at its upper portion, said worm screw lying in a direction substantially parallel to that from which the projectiles come; motorization or driving means (3) for said worm screw (2); and means for separating by the action of gravity the exploded projectiles from said granulated material; said half cylinder (4) being connected, at its rear terminal part, with said mechanical means (7, 8, 9) which are employed for sending the material to the top of the heap (1).

## CONVEYING AND SEPARATION UNIT FOR BALLISTIC PROJECTILE ARRESTERS

This invention relates to a conveying and separation unit or assembly for ballistic projectile arresters, and more particularly an assembly of the type mentioned above that allows the mixture of the impact material and of exploded projectiles to be conveyed and the latter to be separated before said impact material is sent again up to the top of the heap of the material itself.

Self-regenerating ballistic projectile arresters have been realized recently, i.e., projectile arresters of the type endowed with an automatic system for regenerating the projectile impact material in indoor firing grounds, after separation of the exploded projectiles.

The most innovative solution in such field have been realized and patented by the same Applicant.

In each one of them a heap of the impact material was provided, mainly consisting of a granulated material, which was changed by causing the same to run through conveyor belts towards a collection point where the material was separated from the exploded projectiles before sending it to the top of the heap by means of a mechanical system.

In the present invention the Applicant suggests the realization of a further improvement in such type of projectile arresters, in particular as regards the assembly for conveying the granulated material and for separating the same from the exploded projectiles.

The assembly or unit according to this invention has been particularly designed for being adopted in the already existing projectile arresters having the standard chute made up of a ballistic metal plate.

It is a further object of the present invention that of realizing an assembly which, in the realization of a new projectile arrester, requires for being installed just an extremely slight sinking in the ground level with respect to the floor-level of the indoor firing ground, as compared to that asked for by the similar devices adopted at the present time.

These and other results are obtained according to the present invention by realizing a conveying and separation assembly of the impact material, said assembly comprising a worm screw or helical screw which is introduced into the lower portion of the heap of impact material, and rotates about a horizontal axis, said worm screw or auger bearing at its rear end a set of vanes that serve the purpose of disgregating the granulated material that has possibly caked, said assembly also comprising a system for separating the projectiles by gravity.

Accordingly, it is a specific object of the

present invention a conveying and separation assembly for the impact material of a ballistic projectile arrester for indoor firing grounds, of the type comprising a heap of granulated material as the impact material, and mechanical means for sending said granulated material up to the top of the heap after separation of the exploded projectiles, wherein said assembly comprises a variable-diameter worm screw or helical screw that rotates about a horizontal axis and is arranged within a half cylinder which is open at its upper portion, said worm screw or auger lying in a direction substantially parallel to the direction from which the projectiles come; means for motorization or driving of said worm screw or auger; and means for gravity separation of the exploded projectiles from the granulated material; said half cylinder being connected at its rear terminal portion with said mechanical means for sending the material to the top of the heap.

Obviously, a number of units or assemblies according to the present invention can be provided in a ballistic projectile arrester, as parallel-arranged units.

According to a preferred embodiment of the assembly of the present invention, a further worm screw will be provided on the shaft of the worm screw mentioned previously at the rear end of said shaft and before said separation means, for disgregating the granulated material that has caked possibly in an anomalous way.

Preferably, said variable-diameter worm screw has three or more diameters of different sizes.

The assembly according to the invention can be employed in a ballistic projectile arrester with the impact material arranged according to its free slope.

The motorization or driving means of said worm screw are provided in front of the shaft of the worm screw itself.

The assembly according to this invention, which as mentioned above is arranged at a lower level with respect to the impact material heap, can be provided within a specific housing obtained in the floor of the firing ground itself, or at the same level as the floor of said firing ground. In that case, a protective plate consisting of a ballistic material can be provided in front of the motorization or driving means for the worm screw.

This invention will be disclosed in the following according to some preferred embodiments of the same, with particular reference to the figures of the enclosed drawings, wherein:

Figure 1 is a plan view of an embodiment of the assembly according to the present invention;

Figure 2 is a cross-sectional view along the

line A-A of Figure 1;

Figure 3 is a cross-sectional view along the line B-B of Figure 2;

Figure 4 is a cross-sectional view along the line C-C of Figure 2; and

Figure 5 is a longitudinal cross-sectional view of a second embodiment of the assembly according to the present invention.

With reference now to Figures 1-4, it can be observed that there is a heap 1 of impact material, below which the variable-diameter worm screws 2 are provided, which rotate about their horizontal axis, driven by the motorization means 3.

Each one of said worm screws 2 has three distinct diameters that increase in the direction along which the material 1 is dragged, so that a full renewal of the material itself is ensured, said worm screws drawing the granules in a continuous way along their whole length.

Each one of said worm screws 2 is contained in a half cylinder 4 which is half open at its upper portion, and is connected to the half cylinder 4 in the adjacent position by means of the shaped metal plates 5 that facilitate the confluence of the material towards the worm screws 2.

In the embodiment shown in Figures 1-4, as the worm screw 2 is assembled at the level of the floor of the firing ground, a plate 6 is provided in front of the motorization or driving means 3, said plate serving the purpose of deflecting projectiles possibly exploded in the wrong direction.

The rear part of each half cylinder 4 is connected to the conveyor conduits 7, through which the air forced by the electric fan 8 passes at high speed.

The material is then pushed again to the top of the heap 1 through the conveyor means 7, while air is taken in again through the conduit 9.

The horizontal shaft of the worm screw 2 is connected to the motorization or driving means 3 through ratomotors that can be inspected through a door 10.

Ball bearings supported by metallic plates which are arranged inside said half cylinder at points corresponding to the rear part of the horizontal shaft of the worm screw 2 keep the coaxial shaft in place. Said metallic plates in addition make the flow of the material more regular.

Moreover, the rear end of the shaft of the worm screw 2 causes the fins or vanes 11 to rotate, said vanes giving rise to the disgregation of any material that has possibly caked during the path through the worm screw 2.

The separation of the material from the exploded projectiles occurs at the base of the delivery conduit 7, to said separation being realized by the action of gravity.

The plate 6 for protection of the motorization or

driving means 3 is assembled at a slope of 8°, and rises from the floor by about 40 cm.

Each one of the modules of said ballistic projectile arrester is of 2.40 m width and the modules can be coupled so as to obtain a total width that is an integral multiple of 2.40 m according to the actual requirements.

According to the kind of embodiment shown in Figure 5, the only difference consists in that the assembly according to the present invention is arranged in a sinking obtained in the floor of the firing ground, of about 40 cm depth, so that it is not necessary to provide the plate 6.

Obviously, the assembly according to the present invention can be provided with mechanical means for conveying the granulated material already separated from the exploded projectiles up to the top of the heap, said mechanical means being different from those illustrated in the figures.

This invention has been disclosed with specific reference to some preferred embodiments of the same, but it is to be understood that modifications and/or changes can be introduced by those who are skilled in the art without departing from the spirit and the scope of the invention for which a priority right is claimed.

## Claims

1. A conveying and separation assembly for the impact material of a ballistic projectile arrester for indoor firing grounds, of the type that comprises a heap of granulated material as the impact material, and mechanical means for sending said granulated material once it has been separated from the exploded projectiles up to the top of said heap, said assembly being characterized in that it comprises a variable-diameter worm screw or auger, that rotates about a horizontal axis and is arranged within a half cylinder that is open in its upper portion, said worm screw lying in a direction substantially parallel to that from which the projectiles come; motorization or driving means for said worm screw or auger; and means for the separation by the action of gravity of the exploded projectiles from said granulated material; said half cylinder being connected at its rear terminal part with said mechanical means for sending the material to the heap.

2. A conveying and separation assembly for the impact material according to claim 1, characterized in that a number of parallel-arranged assemblies are provided in the same ballistic projectile arrester.

3. A conveying and separation assembly for impact material according to any one of the preceding claims, said assembly being characterized

in that a further vane-bearing worm screw for disgregating the anomalously caked granulated material is provided on the shaft of said worm screw or auger at its rear end and before said separation means.

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4. A conveying and separation assembly of the impact material according to any one of the preceding claims, characterized in that said worm screw or auger has at least three distinct diameters whose sizes increase in the direction along which the material is dragged.

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5. A conveying and separation assembly for the impact material according to any one of the preceding claims, characterized in that it is employed in a ballistic projectile arrester, the impact material being so arranged that it assumes its free slope.

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6. A conveying and separation assembly for the impact material according to any one of the preceding claims, characterized in that motorization or driving means are provided in the front position on the shaft of the worm screw or auger.

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7. A conveying and separation assembly for the impact material, characterized in that such assembly is provided inside a housing which is obtained in the floor of the firing ground.

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8. A conveying and separation assembly for the impact material according to any one of the preceding claims 1-6, said assembly being characterized in that it is provided at the same level as the floor of the firing ground.

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9. A conveying and separation assembly for the impact material according to claim 8, characterized in that a protection plate made up of a ballistic material is arranged at a slope in front of said motorization or driving means of said worm screw or auger.

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10. A conveying and separation assembly for the impact material in ballistic projectile arrester, according to each one of the preceding claims and substantially as illustrated and disclosed above.

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FIG. 1

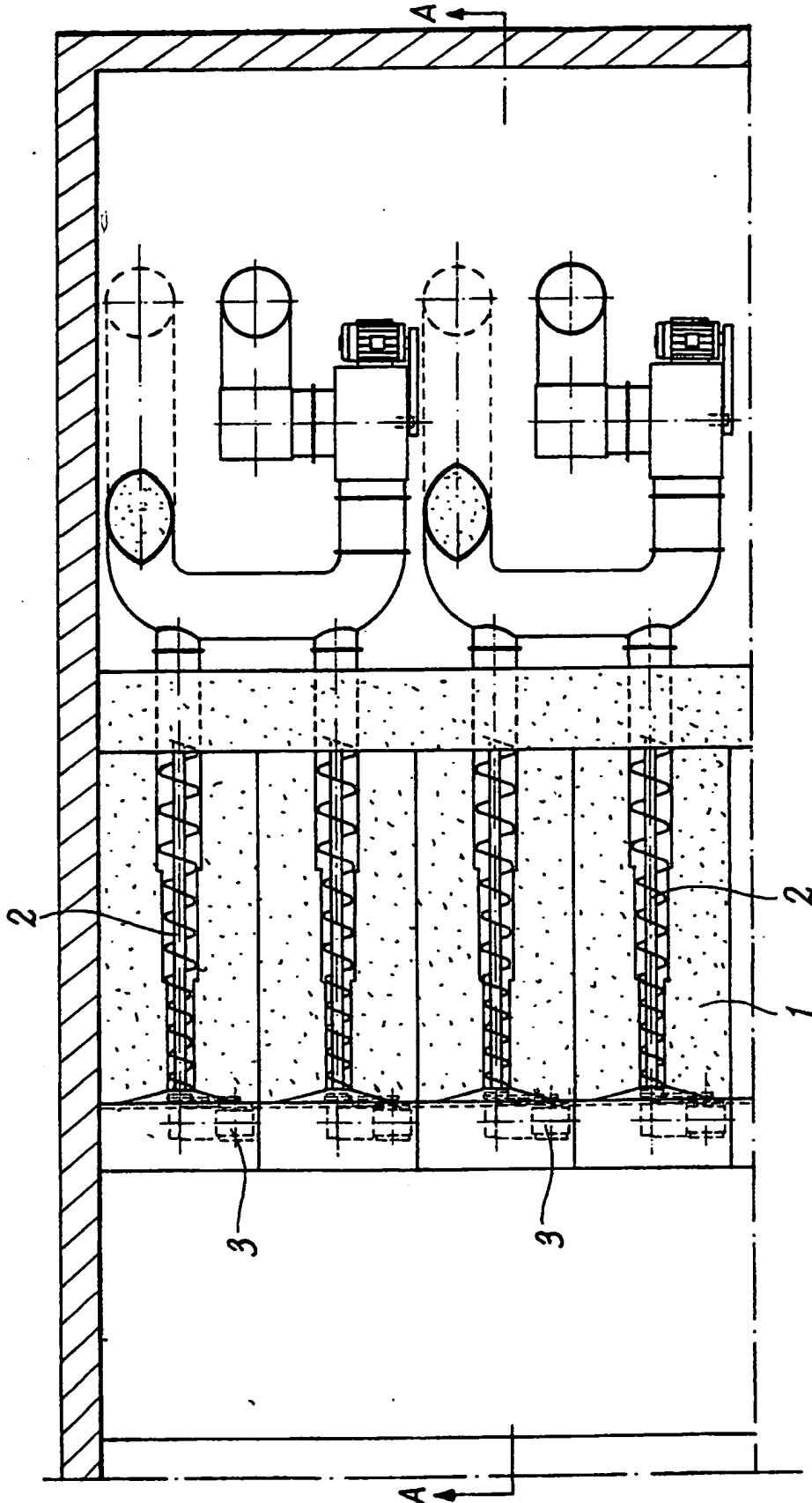
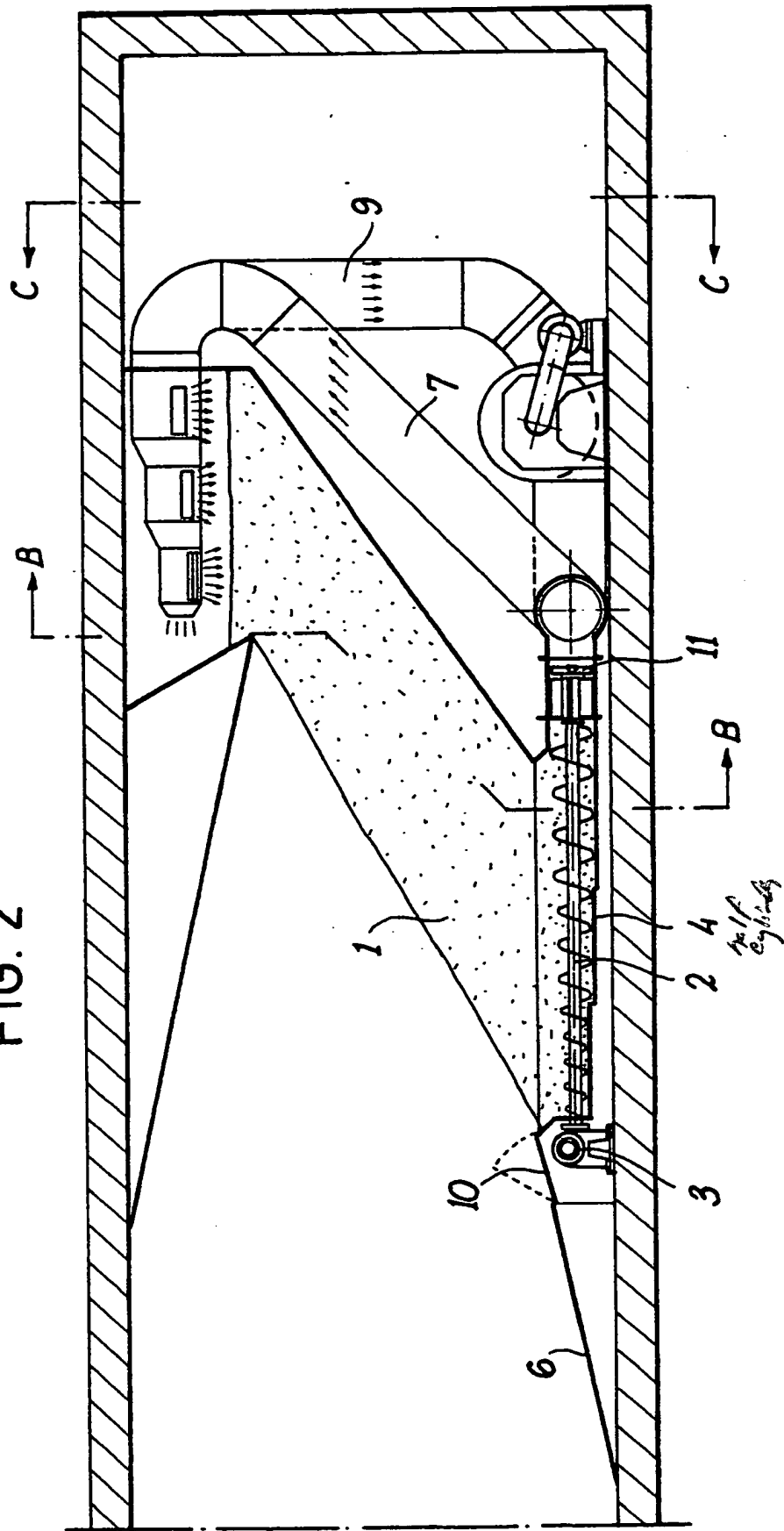


FIG. 2



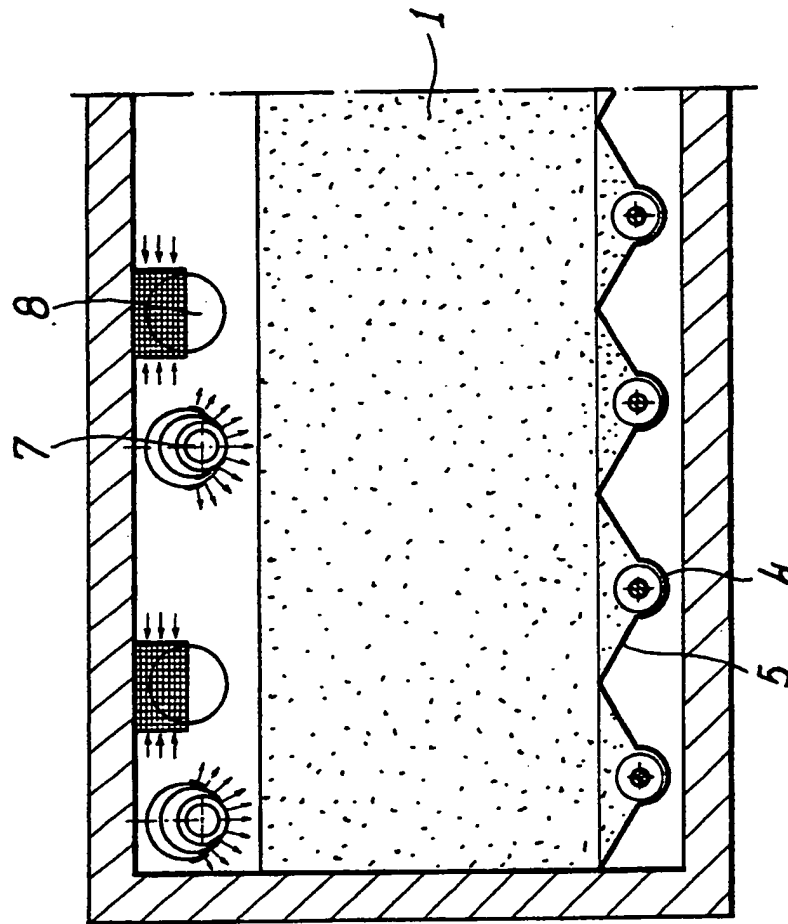


FIG. 3

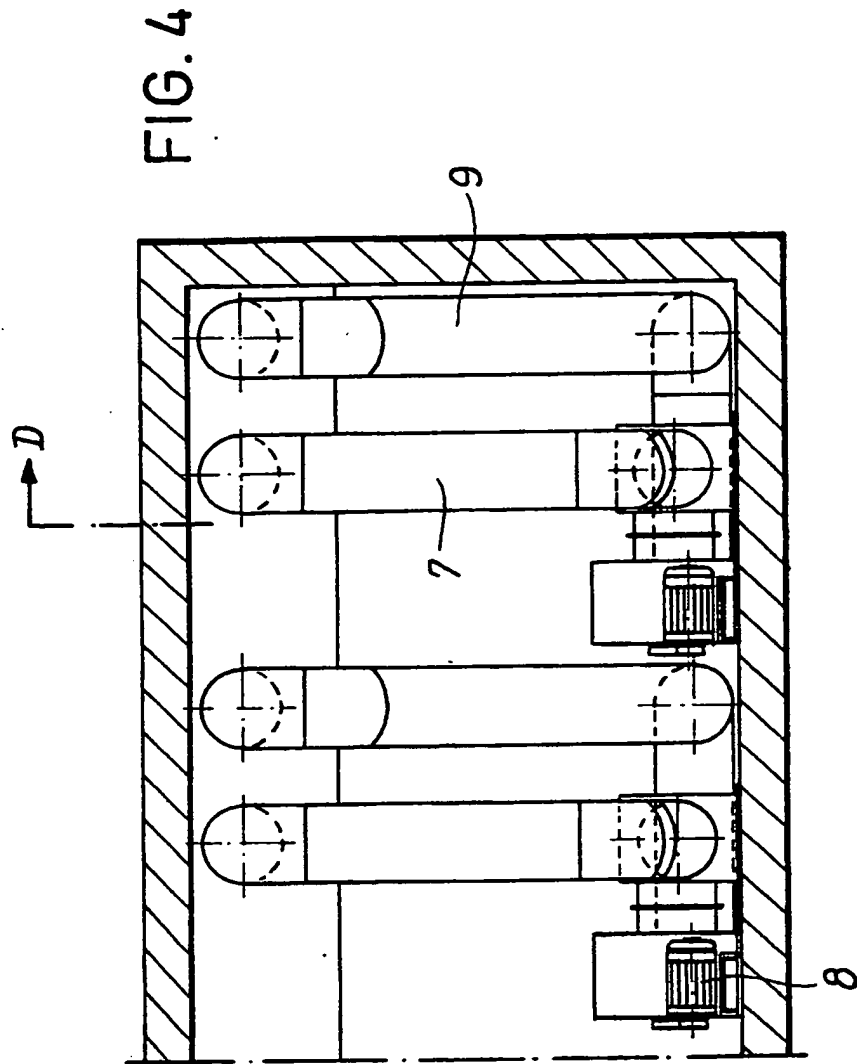
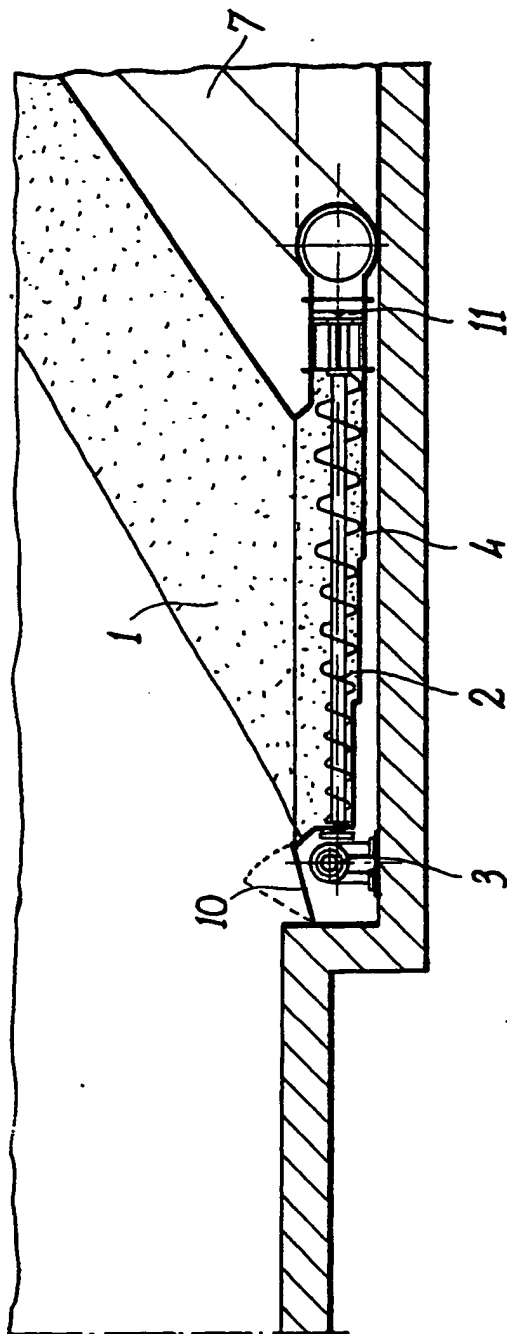




FIG. 5



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